U.S. DEPARTMENT OF COMMERCE PATENT & TRADEMARK OFFICE

B/O Form PTO-1390 **Transmittal Letter to the United States Designated/Elected Office (DO/EO/US) Concerning a Filing Under *35 USC 371***		*Attorney's Docket Number* JEK/KAULE
		U.S. Application Number (if known) 09/147398
International Application Number PCT/EP97/03120	*International Filing Date* 16 June 1997	*Priority Date Claimed* 17 June 1996
Title of Invention A METHOD FOR PRODUCING EMBOSSING PLATES		
Applicant(s) for DO/EO/US KAULE et al.		

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items under *35 USC 371*:

1. ☒ This is a **FIRST** submission of items concerning a filing under *35 USC 371*.

2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under *35 USC 371*.

3. ☐ This express request to begin national examination procedures *(35 USC 371(f))* at any time rather than delay examination until the expiration of the applicable time limit set in *35 USC 371(b)* and PCT Articles 22 and 39(1).

4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. ☒ A copy of the International Application as filed *35 USC 371(c)(2)*
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).

6. ☒ A translation of the International Application into English *(35 USC 371(c)(2))*.

7. ☒ Amendments to the claims of the International Application under PCT Article 19 *(35 USC 371(c)(3))*
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.

8. ☐ A translation of the amendments to the claims under PCT Article 19 *(35 USC 371(c)(3))*.

9. ☒ An oath or declaration of the inventor(s) *(35 USC 371(c)(4))*. (☐ Executed ☒ Unexecuted)

10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 *(35 USC 371(c)(5))*.

Items 11 to 16 below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under *37 CFR 1.97* and *1.98*.

12. ☐ An assignment document for recording. A separate cover sheet in compliance with *37 CFR 3.28* and *3.31* is included.

13. ☒ A **FIRST** preliminary amendment.
    ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.

14. ☐ A substitute specification.

15. ☐ A change of power of attorney and/or address letter.

16. ☐ Other items or information:

Application Number (if known)	*International Application Number* PCT/EP97/03120	*Attorney's Docket Number* JEK/KAULE

	CALCULATIONS	PTO USE ONLY
17. ☒ *The following fees are submitted:* **Basic National Fee** *(37 CFR 1.492(a)(1)-(5))*:		
☒ Search report has been prepared by the EPO or JPO $840.00		
☐ International Preliminary Examination Fee paid to USPTO *(37 CFR 1.482)* . . $670.00		
☐ No International Preliminary Examination Fee paid to USPTO *(37 CFR 1.482)* but International Search Fee paid to USPTO *(37 CFR 1.445(a)(2))* $760.00		
☐ Neither International Preliminary Examination Fee *(37 CFR 1.482)* nor International Search Fee *(37 CFR 1.445(a)(2))* paid to USPTO $970.00		
☐ International Preliminary Examination Fee paid to USPTO *(37 CFR 1.482)* and all claims satisfied provisions of PCT Article 33(1)-(4) $96.00		
ENTER APPROPRIATE BASIC FEE AMOUNT	$ 840.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date *(37 CFR 1.492(e))*.	$ N/A	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total Claims	35 -20 =	15	× $18.00	$ 270.00	
Independent Claims	3 -3 =	0	× $78.00	$ .00	
Multiple dependent claim(s) *(if applicable)*			+ $260.00	$ N/A	
TOTAL OF ABOVE CALCULATIONS				$ **1110.00**	
Reduction by ½ for filing by small entity, if applicable. Verified Small Entity Statements must also be filed. (Note *37 CFR 1.9, 1.27, 1.28*)				$ N/A	
SUBTOTAL				$ **1110.00**	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date *(37 CFR 1.492(f))*.				$ N/A	
TOTAL NATIONAL FEE				$ **1110.00**	
Fee for recording the enclosed assignment *(37 CFR 1.21(h))*. The assignment must be accompanied by an appropriate cover sheet *(37 CFR 3.28, 3.31)*. **$40.00** per property.				$ N/A	
TOTAL FEES ENCLOSED				$ 1110.00	
Amount to be:				**Refunded:**	$
				Charged:	$

a. ☒ A check in the amount of $ 1110.00 to cover the fees is enclosed.

b. ☐ Please charge my **Deposit Account Number 02-0200** in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to **Deposit Account Number 02-0200**. A duplicate copy of this sheet is enclosed.

Note: Where an appropriate time limit under *37 CFR 1.494* or *1.495* has not been met, a petition to revive *(37 CFR 1.137(a) or (b))* must be filed and granted to restore the application to pending status.

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Respectfully Submitted,

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Date: December 17, 1998

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	
KAULE et al.	**PCT/DO/EO/US**
International Application No. PCT/EP97/03120	
International Filing Date: 16 June 1997	

For: A METHOD FOR PRODUCING EMBOSSING PLATES

COMMUNICATION AND PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

This paper accompanies a Request to Process the U.S. National Stage of the above-identified international patent application. The specification, drawings and claims were amended during International Preliminary Examination of the application and examination of the application as amended is respectfully requested.

The substitute pages of the specification contained in the annexes to the International Preliminary Examination Report presumably will be entered in the application as well as the amendments to the claims and drawings.

PRELIMINARY AMENDMENT

Before calculation of the filing fees and before examination, kindly amend this application as follows:

IN THE CLAIMS:

Please amend the claims **as annexed to the International Preliminary Examination Report** as follows:

Claim 3, line 1, delete "or 2".
Claim 4, line 1, change "any of claims 1 to 3" to --claim 1--.
Claim 5, line 1, change "any of claims 1 to 3" to --claim 1--.
Claim 6, line 1, change "any of claims 1 to 5" to --claim 1--.
Claim 7, line 1, change "any of claims 1 to 6" to --claim 1--.
Claim 10, line 1, change "any of claims 7 to 9" to --claim 7--.
Claim 12, line 1, change "any of claims 1 to 11" to --claim 1--.
Claim 14, line 1, change "any of claims 1 to 13" to --claim 1--.
Claim 15, line 1, change "any of claims 1 to 14" to --claim 1--.
Claim 16, line 1, change "any of claims 1 to 14" to --claim 1--.
Claim 18, line 1, change "any of claims 1 to 17" to --claim 1--.
Claim 19, line 1, change "claims 1 to 18" to --claim 1--.
Claim 20, line 1, change "claims 1 to 18" to --claim 1--.
Claim 21, line 1, delete "or 13".
Claim 25, line 1, delete "or 24".
Claim 26, line 1, change "any of claims 23 to 25" to --claim 23--.
Claim 27, line 1, change "claims 23 to 26" to --claim 23--.
Claim 28, line 1, change "claims 23 to 27" to --claim 23--.
Claim 29, line 1, change "any of claims 23 to 28" to --claim 23--.
Claim 30, line 1, change "any of claims 23 to 29" to --claim 23--.

Claim 31, line 1, change "any of claims 23 to 30" to --claim 23--.

Claim 32, line 1, change "any of claims 23 to 31" to --claim 23--.

Claim 33, line 1, change "any of claims 23 to 32" to --claim 23--.

Claim 34, line 1, change "any of claims 23 to 33" to --claim 23--.

Claim 35, line 1, change "any of claims 23 to 33" to --claim 23--.

REMARKS

The claims have been amended to correct improper multiple dependent claims and to reduce the filing fees. Examination of the claims as amended is respectfully requested.

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A method for producing embossing plates

This invention relates to a method for producing embossing plates, in particular steel intaglio printing plates, according to the preamble of claim 1.

For producing embossing plates, in particular steel intaglio printing plates, as are usually employed for printing high-quality printed products such as papers of value, bank notes or the like one has hitherto resorted to having the embossing plates produced in an elaborate method by an artist. A picture motif made available to the artist is converted into a line pattern whereby lines of different width, depth and a different number per unit area represent the gray levels of the original. Using a chisel, the artist brings this motif in time-consuming hand labor into the metal plate, for example steel or copper. The thus produced plates are characterized by their high quality with respect to use in steel intaglio printing. However the possibilities of correction are extremely low for the artist during production of the plate. If this original plate is damaged or lost, no identical plate can be produced since each plate is an individual production.

It is also known to perform the engraving of a printing cylinder by machine. As described in EP 0 076 868 B1 for example, cups are brought into the printing form which represent the gray level value of a master depending on their screen width and engraving depth. Light tones and tone-dependent changes in the master are produced by varying the focal value of the electron beam in the printing form, whereby cups of different volume can arise.

From DE 30 08 176 C2 it is also known to use a laser for engraving a printing cylinder. An original is scanned and the resulting signal used via an analog-to-digital converter for controlling the laser with which engraved cups of defined depth and extension are brought into the printing cylinder.

When the original is broken down into gray-level values represented on the printing plate by cups, the essential components necessary for steel intaglio printing are lost, since this technique is only able to transfer ink to the print carrier point by point. Steel intaglio printing, however, is characterized by the fact that a continuous

linear printing pattern tangible with the inking is transferred to the print carrier, characterized in particular by its filigreed design.

The problem of the invention is accordingly to propose a method permitting simple and automated production of embossing plates, in particular steel intaglio printing plates.

This problem is solved by the characterizing features of claim 1.

The invention is based on the finding that it is possible to treat a two-dimensional line original graphically such that the existing lines are interpreted as areas. These areas are limited by edges, these edges defining a desired contour of the area. Starting out from this desired contour one determines a tool track along which an engraving tool can be guided such that material is removed within the area limited by the desired contour. The engraving tool is controlled such that the material within the desired contour is removed in the form of continuous or interrupted lines in a certain depth profile. This depth profile can be determined by a depth value that is constant or varies within the desired contour.

The inventive method preferably makes use of a data processing system which makes it possible to acquire, store and process two-dimensional line originals. The two-dimensional line original, which is for example produced in a computer or read in via input devices, can be processed with the aid of a suitable computer program so as to yield data for controlling an engraving tool along a tool track. For this purpose one defines in a first working step from the two-dimensional line original a plane element which consists for example of a single line of the line original. The edge enclosing the line then defines a desired contour which is intersection-free. To produce the engraving one associates a depth profile with the interior of the plane element as the desired depth for the engraving, and then calculates from the desired contour data and the associated desired depth a tool track along which the engraving tool is guided and removes material within the plane element.

This procedure is then repeated for each individual plane element to be engraved so that an engraving tool track can be determined for the entire area to be engraved, composed of the sum of the individual plane elements to be engraved.

Using this method one can considerably increase the speed for producing the embossing plate. Furthermore, errors during engraving are excluded by the exact guidance of the engraving tool so that a multiplicity of embossing plates can be produced with the same exactness. In addition the method offers simple possibilities of correction by changing the data of the line drawing. The exact reproducibility of the engraving to be brought in furthermore permits printing plates to be produced directly without any need for a galvanic shaping process. Several engraving tools can thereby also engrave several plates simultaneously. Furthermore several, possibly different, engraving tools can also be controlled such that they process a plate simultaneously, thereby optimizing the processing time.

Further advantages and advantageous embodiments will be explained with reference to the following figures, in which a true-to-scale representation was dispensed with for the sake of clearness.

Fig. 1 shows a schematized overall view of the inventive method,

Fig. 2 shows a schematic example of the inventive method,

Fig. 3 shows a schematic example of the inventive method,

Fig. 4 shows a schematic example of the inventive method,

Fig. 5 shows a schematic example of the inventive method,

Fig. 6 shows a schematic cross section through an embossing plate,

Fig. 7 shows a schematic example of the inventive method,

Fig. 8 shows a schematic example of a tool track,

Fig. 9 schematically shows two tool point forms,

Fig. 10 shows a schematic cross section through an embossing plate,

Fig. 11 shows a schematic cross section through an embossing plate.

As shown in Fig. 1, the inventive method starts out from two-dimensional line original 1, consisting of simple black line 2 on light background 3 to illustrate the inventive principle. The original, which is present on paper for example, can be digitally acquired in a computer with the aid of a scanner or another suitable data input means. Alternatively it is also possible to produce the line original directly on the computer interactively, using for example a plotting or graphics program, or to have the computer produce certain graphic data by mathematical algorithms. If the

original is designed in the latter way, guilloche lines or other graphic elements could be produced for example with the aid of implemented programs which permit interactive input or presetting of data or calculation of the structures with the aid of random algorithms. From line original 1 one defines in a second method step an area, e.g. area 4, which represents a partial area of the plate. The edge of this area defines desired contour 5 which serves as the first of two elements as the starting point for subsequent calculation of a tool track along which the embossing plate is to be engraved. As the second element for calculating the tool track it is necessary to associate a depth profile within the desired contour, which is termed the so-called desired depth. This can be preset constantly for the entire engraving for example. It can also depend on the form of the engraving tool used. From desired depth 6 and desired contour 5 one then calculates tool track 10 located within area 4 along which the engraving tool must be moved so that the engraving corresponding to the line drawing can be brought into the embossing plate.

Since different engraving tools can be used for engraving the plate, it is clear that data of the particular engraving tool also enter into the calculation of the tool track. If a laser beam is used, the width of the beam acting on the embossing plate can be included in the calculation for example. If a mechanical chisel is used, the chisel form, in particular the form of the point or its radius of curvature, is of essential importance for calculating the tool track.

The engraving tool is controlled subsequent to the determination of the tool track such that it moves within area 4, does not hurt desired contour 5 during engraving and removes area 4 at predetermined desired depth 6.

In a specific embodiment, shown in Fig. 2, the number "7" is produced as a line original on a sheet of paper and read into a computer with the aid of a scanner. The number "7" consists of lines 7, as shown in Fig. 2(a). Using the above-described procedure one defines from existing lines 7 areas 8 whose edges form desired contours 9, as shown in Fig. 2(b). These serve as a starting point for calculating a tool track. Through the association of a desired depth, which is constant in this case, one can determine with consideration of the particular tool data tool tracks 10, 11 and 12 along which the engraving tool is controlled over the embossing plate so that the line

drawing can be transferred to the embossing plate. These tool tracks are shown by way of example in Fig. 2(c). Tool tracks 10, 11 and 12 are preferably determined such that the tool is guided along desired contours 9 within areas 8 without hurting the desired contours.

Since the width of the material removed with the engraving tool is limited, one can define via the line drawings plane elements with a size which cannot be removed completely if the engraving tool is guided only along the desired contour lines. A very simple form of line drawing is shown by way of example in Fig. 3. Via the line drawing of Fig. 3(a) one defines plane element 8 having contour line 9. When tool track 13 is now calculated on the basis of these given data, as shown in Fig. 3(b), the engraving tool cannot in one cycle completely remove the area to be removed, depending on the dimensioning of area 8 and the form of the engraving tool.

For rotating 14 chisel these relations are shown in perspective in Fig. 4. Chisel 14 rotates about its own axis z and, after penetrating into embossing plate 15, removes material from the embossing plate along tool track 13 at a predetermined depth. Due to the guidance of rotating chisel 14 along tool track 13, desired contour line 9 remains intact. Because of the limited width of the chisel, however, residual area 16 of area 8 to be removed cannot be removed in one cycle of the engraving tool. Only in a further operation can residual area 16 be removed using a second predetermined tool track, which can differ in form from first tool track 13.

As to be seen in Fig. 5(a), it is necessary in this case also to consider residual area 16 not removable in the first step when calculating the tool track for removing area 8. For removing residual area 16 one can determine different tool tracks depending on the desired engraving results. Thus the tool track can, as shown in Fig. 5(b), first extend along the desired contour and residual area 16 then be removed in a meander shape, the engraving tool removing the residual area continuously in meander-shaped track 17 within area 16. Fig. 5(c) shows a further possibility whereby residual area 16 is removed by guidance of the engraving tool along tool tracks which are similar in the mathematical sense to tool track 12 first calculated, i.e. tool tracks 18, 19 and 20 correspond to tool track 12 in form but have a different dimension from tool track 12. Particularly in the case of curved contour lines, residual area

16 can accordingly be removed using tool tracks which extend contour-parallel, i.e. are equidistant from the contour line at each point.

As to be seen in Fig. 6(a) in a cross section through embossing plate 15, one calculated from contour line 9 a tool track along which the engraving tool was guided, thereby producing engraved line 28 enclosing residual area 16 yet to be engraved. To remove residual area 16 one can use any method but preferably one of the above-described. Regardless of the particular method one produces at the base of the residual area engraving a defined roughness structure determined by the offset and form of the engraving tool. Fig. 6(b) shows such a roughness structure, whereby a tapered, rotating graver was used for engraving, removing the embossing plate at defined depth *T*. The chisel used had diameter *D* on the surface emerging from the embossing plate and was offset inward by the amount *d*/2 during removal of the residual area, while the offset is 3/4 *d* in the example shown in Fig. 6(c). The engraving tool was moved in accordance with the tool tracks shown in Fig. 5(c) in both examples.

The described surface structuring at the base of the embossing has several advantages for producing steel intaglio printing plates. Using steel intaglio printing plates one could hitherto print only limited line widths, due to the fact that the steel intaglio printing ink can only be brought into engravings of the plate which have a certain maximum width. This obstacle is eliminated by the newly proposed engraving since one can now adjust the roughness as a base pattern at the base of the engraving to serve as an ink trap for a steel intaglio printing ink brought in. This ink can thus be held even in very wide engraved lines so that it is now possible for the first time to print wide lines by steel intaglio printing. As shown in Figs. 6(b) and 6(c), the roughness of the base can be controlled via the size of the engraving tool offset. Since different offset widths of the chisel can also be considered in the calculation of the tool track, the roughness can be different at the base in different areas of the residual area and thus the engraved line or area be superimposed with an additional modulation of the roughness of the base pattern. It is thus also possible to bring further information into an engraved line solely by selectively producing the roughness of the base pattern.

Since transparent inks are usually employed in steel engraving, a different color effect within a line can be produced on the document to be printed with the aid of the different engravings within a line. This color effect can be improved further in particular if the engraving already produced is provided in a further method step with a second engraving whose desired depth has a different definition from that of the first engraving. Fig. 7 shows an example of this in which line drawing 18 with lines 19 is present. Lines 19 are limited by desired contour lines 20. Within lines 19 there are areas 21 limited in turn by second desired contour lines 22. This line original is brought into a computer as a digital data image or produced directly therein. As shown in a detail in Fig. 8, one calculates from contour lines 20, together with a desired depth firmly preset in this case, tool track 23 along which a first engraving takes place. Any remaining residual area is removed at a given desired depth, as described above. Area 21 located within line drawing 19 is converted into tool track 24 in the same way, the contour of area 21 and a second desired depth different from the first being included in the determination of the tool track as a basis for conversion. One can thus produce engravings containing additional information even over a large surface area, which can be transferred to the document at the same time by the steel intaglio printing process.

The tapered edges of line drawing 19 can be rendered exactly by a suitable choice of chisel form. It is possible to use a single fine chisel for the engraving, or rework the tapered edges with a fine chisel after engraving the area with a coarse chisel. As an alternative to this possibility one can also adapt the depth profile to the requirements of area 19 to be engraved. In this case the depth profile is preset such that the engraving tool removes less material at the tapered edges so that, in particular if a rotating mechanical chisel is used, the chisel emerges ever further out of the material to be processed and due to the conic form therefore the removed line becomes narrower. These two techniques can also be used for exact engraving of corners or edges.

For determining the tool track one generally combines a determined desired contour with an engraving depth profile according to the inventive method, thus determining from these two data a tool track along which the engraving tool is guided,

so that the material can be removed in accordance with the line drawing at the depth corresponding to the depth profile. The depth profile, i.e. the desired depth, can be preset for each individual engraved line or for the engraving altogether as a constant. Desired depths can also be different for individual engraved lines or parts of engraved lines, so that the particular tool track is accordingly modulated. In addition it is possible to use different engraving tools of like or different kinds in successive method steps in order to produce the desired engraving result. If rotating mechanical chisels are used it is especially advantageous to use different chisel points, forms and sizes, so that optimal embossing plates can be produced in this way.

By producing and using different chisel forms and sizes one can influence the embossing result in a variety of ways. Precisely the form and size of the embossing tool determine the form of the thus produced engraving cross-sectional area, depending on the penetration depth of the engraving tool into the plate. Fig. 9 shows two examples of possible cross-sectional areas of chisel points. In Fig. 9(a) the chisel point is formed so that intersecting line 28 of the envelope of the cone forms a 45° angle with axis of rotational symmetry *S* of the engraving tool. Engraving the plate with this tool thus results in an engraving track whose side walls likewise run to the base of the engraving at a 45° angle. This example shows that different wall inclinations can be produced in the engraving plate by producing gravers with different angles. Along with the wall gradient one can also influence the wall form via the forming of the engraving tool. Fig. 9(b) shows in this connection cross-sectional line 29 of a rotationally symmetric engraving point with which different angular degrees of the engraving walls can be produced at different engraving depths. These two examples indicate that the use of different engraving tools considerably influences the desired engraving result, and optimal results can be achieved for a certain line original with the aid of specially produced engraving tools or engraving tool points. In particular it is possible to produce the engraving tools in their angle and form so that they can remove even very fine areas to be engraved, whereby in the case of fine lines the tool track along which the engraving tool is guided leads along the predetermined line only once within the area to be removed. Due to the special form of the engraving tool, the material within the desired contour is thus removed by a sin-

gle working traverse of the graver. In these cases, the tool track can also lead along a center line located between two desired contour lines and equidistant from the two. A suitable chisel form must then be selected at a given depth profile.

The inventive method offers the crucial advantage that engraving can be performed with exact line control even with extremely small engraving areas or lines. The desired depths which can be reached with the inventive method are preferably between 10 and 150 microns, whereby the desired depths can also be preset by different gray-level values of the line original.

If the original is formed for example by a uniform line pattern, e.g. a guilloche, one can bring in visible information, for example a portrait, by varying the line depth, line width, line density or contour by the method described above. Instead of visually recognizable information, however, one can also bring in different, for example machine-readable, information in this way.

Although the use of different engraving tools already provides a wealth of possibilities for bringing into the embossing plate defined roughness structures at the base of the engraving or additional information, which can be called micro-engraving in the present case, the inventive method can of course also be used to modify the flanks of the engraving along the desired contours. Fig. 10 shows an example of this whereby an engraving consisting in the present case of flank 28 and engraving 29 located on the bottom is brought into embossing plate 15. In an additional operation, additional information in the form of so-called sub- or microstructure lines 30 was brought into flank 28. The flank of the engraved line can thus be provided with an additional information content which can consist for example of simple lines, a step function, characters, patterns, pictures or the like. In particular in the case of gently sloping flanks 28 it is therefore also possible to bring additional information into the flank of an engraved line which extends downward from desired contour line 26.

The inventive method can of course also be employed if a negative image of the line original is to be produced. As shown in Fig. 11, the above-described calculation of the tool track can also be performed if further surface area 25 to be excluded from removal is located within the area to be removed. The tool track is pref-

erably calculated so that the engraving tool runs down the workpiece, i.e. the embossing plate, in a first step such that the embossing plate is removed along desired contour line 26. In a further step, the engraving tool is guided along second desired contour 27 while a residual area possibly remaining between desired contours 26 and 27 is cleared out, as described above.

Claims

1. A method for producing an embossing plate, in particular a steel intaglio printing plate, having at least one depression in the form of a line brought into the surface of the embossing plate, characterized in that the at least one line defines a limited partial area of the surface, the edge of the at least one partial area defining a desired contour, and a tool track located within the desired contour being determined from the desired contour and a desired depth determining the penetration depth of the engraving tool, an engraving tool being controlled along said track such that the material of the partial area is removed within the desired contour at the predetermined desired depth.

2. The method of claim 1, characterized in that at least part of the tool track extends contour-parallel to the desired contour.

3. The method of claim 1 or 2, characterized in that the desired contour is intersection-free.

4. The method of any of claims 1 to 3, characterized in that the desired depth is variable within the tool track.

5. The method of any of claims 1 to 3, characterized in that the desired depth is constant within the tool track.

6. The method of any of claims 1 to 5, characterized in that the material is removed along the tool track within the desired contour by a single working traverse of the graver.

7. The method of any of claims 1 to 6, characterized in that an unengraved residual area located within the partial area is removed along a second tool track.

8. The method of claim 7, characterized in that the residual area is removed by controlling the engraving tool such that it removes the surface of the residual area in tracks which are similar or contour-parallel to the desired contour.

9. The method of claim 7, characterized in that the residual area is removed by controlling the engraving tool such that the surface of the residual area is removed in a meander shape.

10. The method of any of claims 7 to 9, characterized in that the residual area

is removed such that a new surface of defined roughness arises at the base of the engraving of the residual area.

11. The method of claim 10, characterized in that the engraving tool is controlled such that the roughness is executed in the form of grooves.

12. The method of any of claims 1 to 11, characterized in that at least part of the surface removed at a predetermined depth is deepened further in one or more further engraving steps.

13. The method of claim 12, characterized in that the one or more further engraving steps produce humanly recognizable or machine-readable information.

14. The method of any of claims 1 to 13, characterized in that the desired contour is defined with the aid of a data processing system.

15. The method of any of claims 1 to 14, characterized in that the engraving tool is a laser beam.

16. The method of any of claims 1 to 14, characterized in that the engraving tool is a mechanical chisel.

17. The method of claim 16, characterized in that the mechanical chisel rotates during engraving.

18. The method of any of claims 1 to 17, characterized in that engraving tools of different kinds or dimensions are used for producing the embossing plate.

19. The method of claims 1 to 18, characterized in that several plates are engraved simultaneously.

20. The method of claims 1 to 18, characterized in that one plate is engraved with several engraving tools simultaneously.

21. The method of claim 12 or 13, characterized in that the at least one further engraving step is executed with a finer engraving tool than the engraving in the first engraving step.

22. The method of claim 21, characterized in that the at least one further engraving step is performed in a flank sloping from the desired contour.

23. An engraved object, in particular a plate such as an embossing or printing plate, having at least one depression in the form of a line brought into the surface by engraving and having flanks and a bottom, characterized in that the depression has a

substructure representing additional information and the width of the substructure is smaller than that of the depression on the surface of the object.

24. An embossing or intaglio printing plate having at least one depression in the form of a line brought into the surface by engraving and having flanks and a bottom, characterized in that the depression has a substructure whose width is smaller than that of the depression on the surface of the object.

25. The object of claim 23 or 24, characterized in that the substructure is present on the bottom and/or at least one of the flanks of the depression.

26. The engraved object of any of claims 23 to 25, characterized in that the substructure extends at least in partial areas parallel to the direction of the line.

27. The object of any of claims 23 to 26, characterized in that the substructure is meander-shaped.

28. The object of any of claims 23 to 27, characterized in that the substructure defines a roughness.

29. The engraved object of any of claims 23 to 28, characterized in that the substructure is incorporated in the form of characters, pictures, patterns or the like.

30. The engraved object of any of claims 23 to 29, characterized in that the substructure represents machine-readable information.

31. The engraved object of any of claims 23 to 30, characterized in that the substructure is executed in the form of grooves.

32. The engraved object of any of claims 23 to 31, characterized in that the substructure is brought in with the aid of a laser beam.

33. The engraved object of any of claims 23 to 32, characterized in that the substructure is brought in with a mechanical chisel.

34. Use of the engraved object of any of claims 23 to 33 for producing embossing or printing plates.

35. Use of the engraved object of any of claims 23 to 33 for producing documents such as papers of value, bank notes, ID cards and the like.

Abstract

A method is described for producing embossing plates, in particular steel intaglio printing plates. A plane element is determined from a line drawing, the edge of the plane element defining a desired contour. A tool track is then calculated from the desired contour and a desired depth associated with the plane element, to be used for guiding an engraving tool such that the partial area is removed.

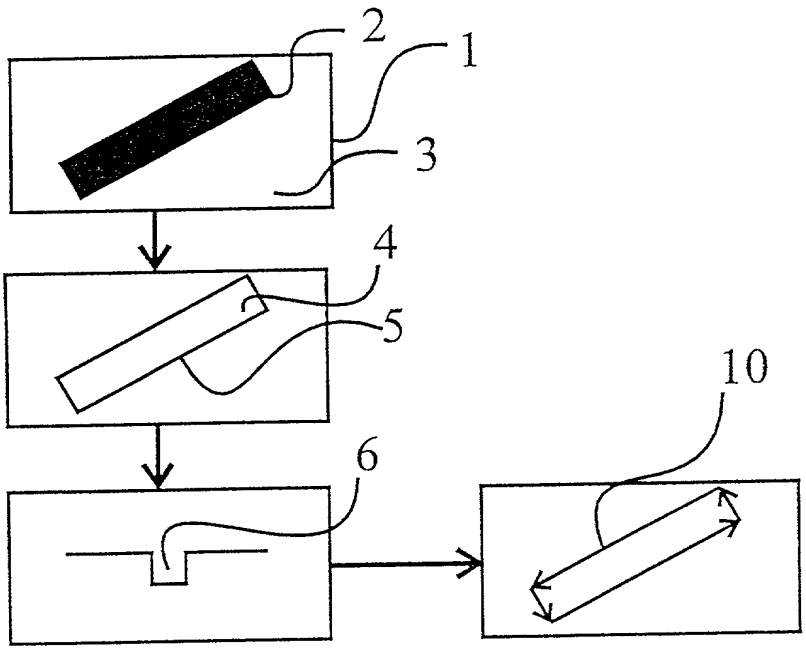


Fig. 1

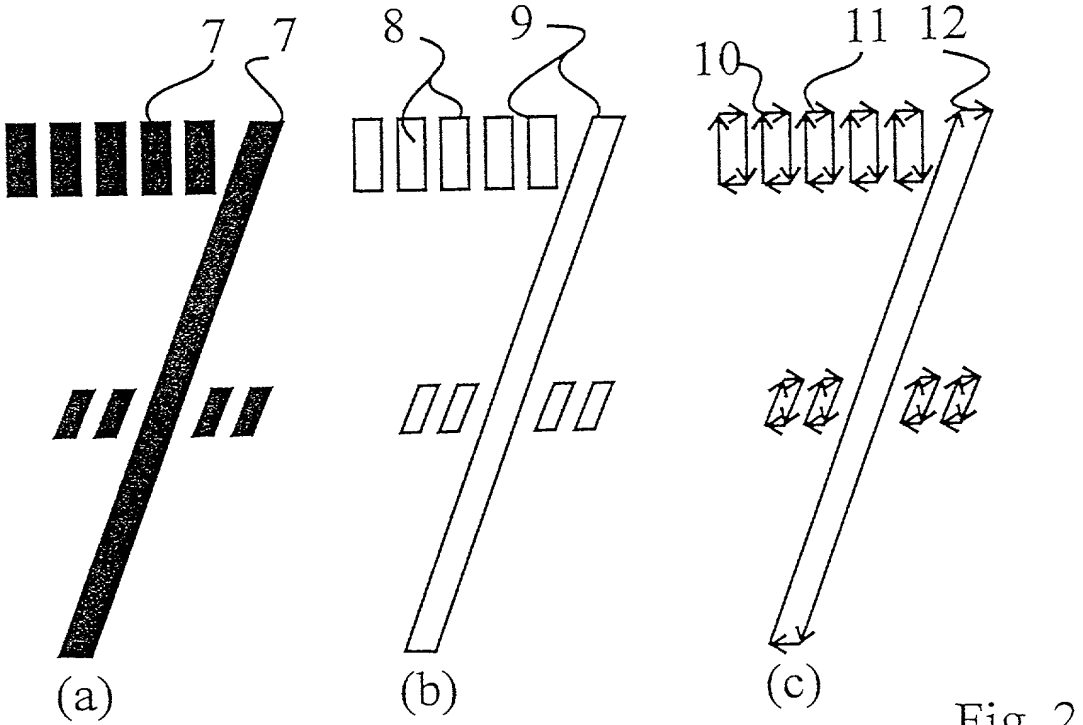


Fig. 2

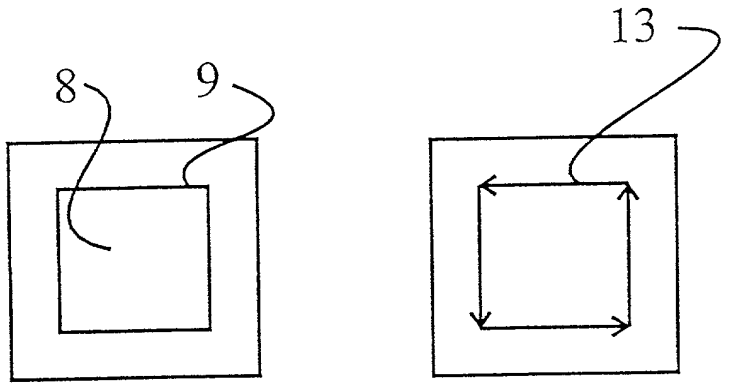


Fig. 3

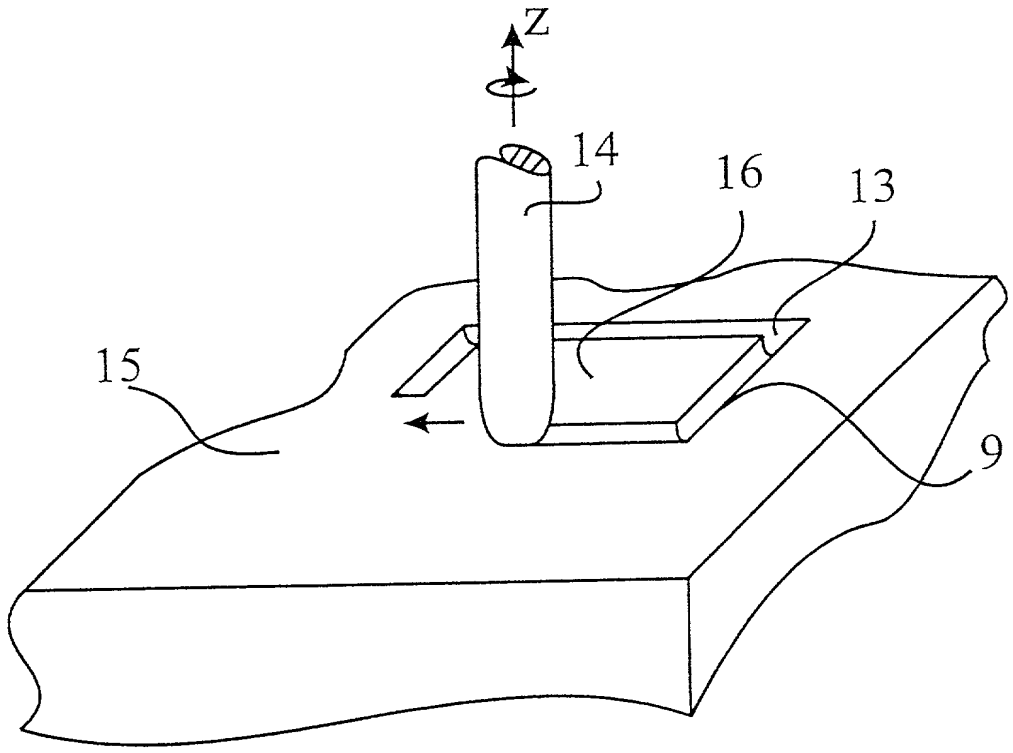


Fig. 4

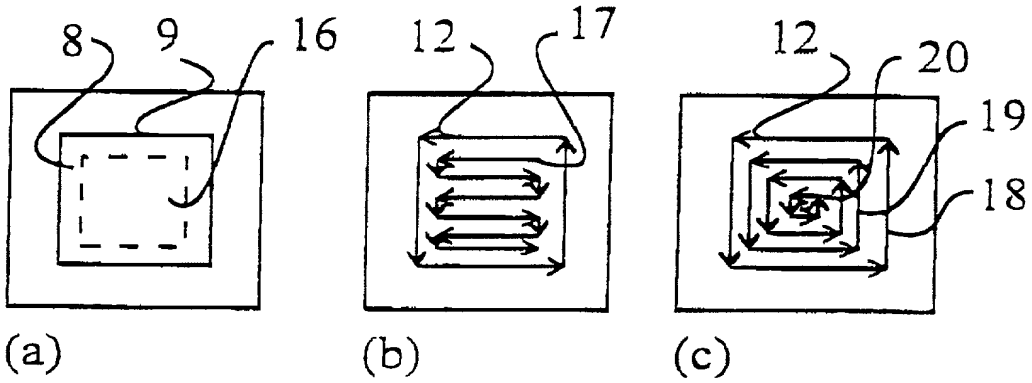


Fig. 5

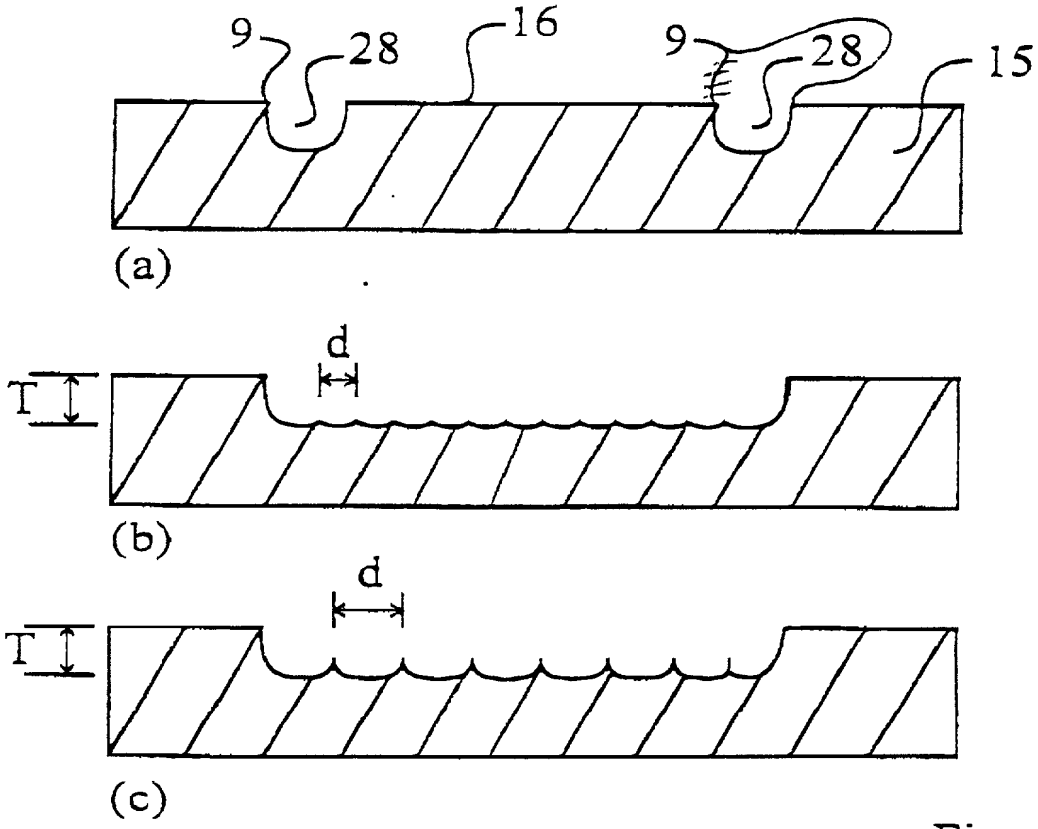


Fig. 6

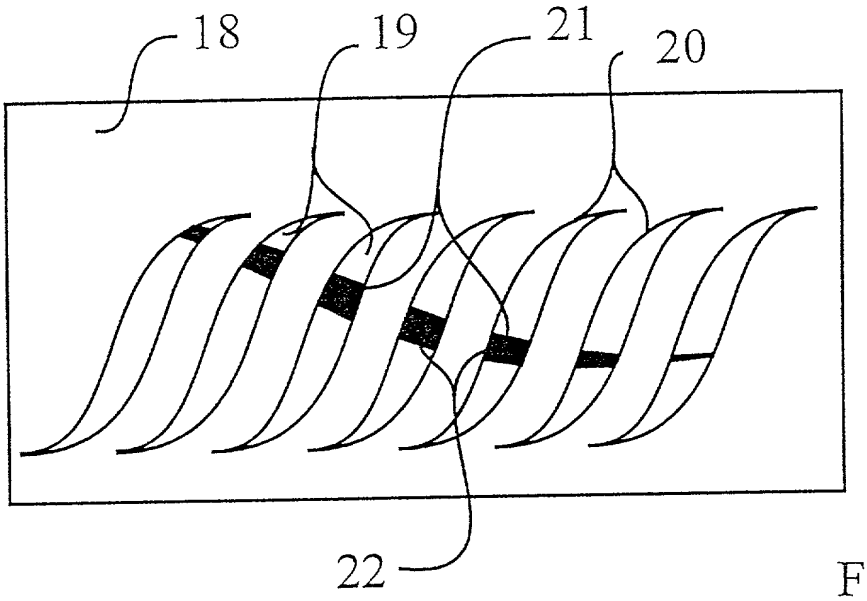


Fig. 7

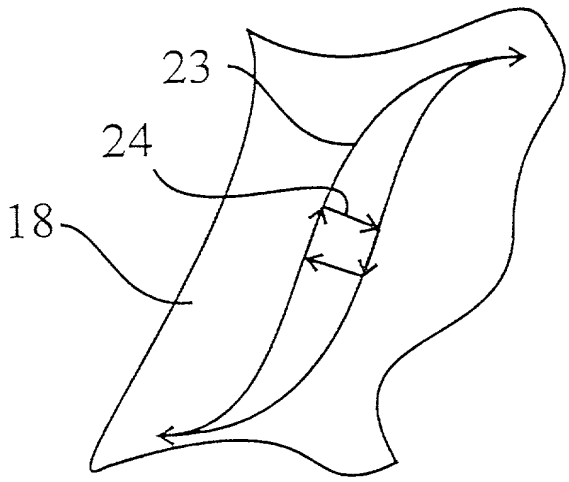
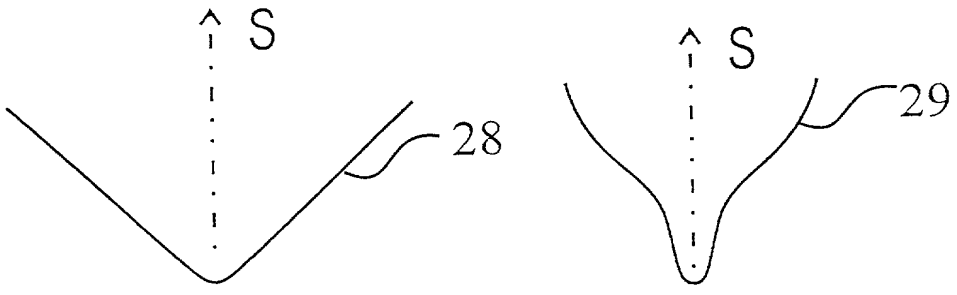


Fig. 8



(a) (b)

Fig. 9

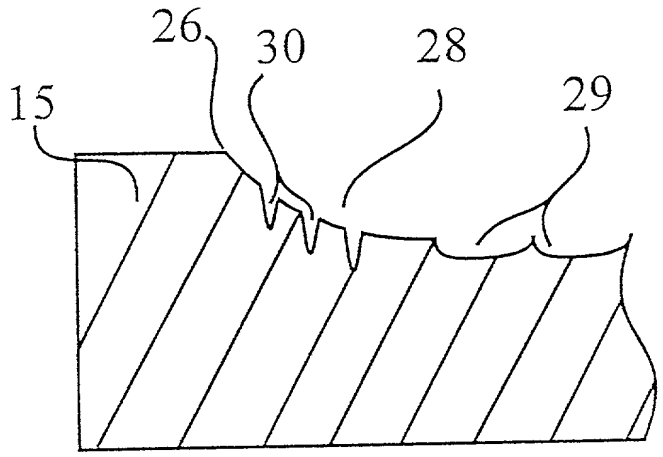


Fig. 10

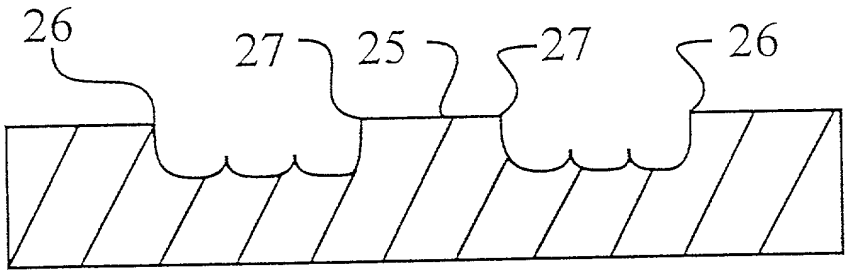


Fig. 11

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DECLARATION FOR PATENT APPLICATION AND APPOINTMENT OF ATTORNEY

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention (Design, if applicable) entitled:

A METHOD FOR PRODUCING EMBOSSING DIES

the specification of which (check one):

☐ is attached hereto, or ☒ was filed on: **16 June 1997** as U.S. Application Number or PCT International Application Number: **PCT/EP97/03120**
and (if applicable) was amended on:

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in *Title 37, Code of Federal Regulations, §1.56.* I hereby claim foreign priority benefits under *Title 35, United States Code §119* of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

PRIOR FOREIGN APPLICATION(S)			PRIORITY CLAIMED	
Number	Country	Day/Month/Year Filed	Yes	No
196 24 131.6	Germany	17 June 1996	X	

☐ Additional Priority Application(s) Listed on Following Page(s)

I HEREBY CLAIM THE BENEFIT UNDER TITLE 35 U.S. CODE §119(E) OF ANY U.S. PROVISIONAL APPLICATIONS LISTED BELOW.	
Application Number	Day/Month/Year Filed

☐ Additional Provisional Application(s) Listed on Following Page(s)

I hereby claim the benefit under *Title 35, United States Code, §120* of any United States application(s) or PCT international application(s) designating The United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of *Title 35, United States Code, §112.* I acknowledge the duty to disclose information which is material to patentability as defined in *Title 37, Code of Federal Regulations, §1.56* which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application:

Application Number	Filing Date	Status - Patented, Pending or Abandoned

☐ Additional US/PCT Priority Application(s) listed on Following Page(s)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under *section 1001 of title 18 of the United States Code* and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: I (We) hereby appoint as my (our) attorneys, with full powers of substitution and revocation, to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: J. Ernest Kenney, Reg. No. 19,179; Eugene Mar, Reg. No. 25,893; Richard E. Fichter, Reg. No. 26,382; Charles R. Wolfe, Jr., Reg. No. 28,680; Thomas J. Moore, Reg. No. 28,974; Joseph DeBenedictis, Reg. No. 28,502; Benjamin E. Urcia, Reg. No. 33,805; and

I(we) authorize my(our) attorneys to accept and follow instructions from _____ regarding any matter related to the preparation, examination, grant and maintenance of this application, any continuation, continuation-in-part or divisional based thereon, and any patent resulting therefrom, until I(we) or my(our) assigns withdraw this authorization in writing.

Send correspondence to: **BACON & THOMAS, PLLC**
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DATE 23 März 1999	SIGNATURE Wittich Kaule

☒ *See following page(s) for additional joint inventors.*

ATTORNEY/DOCKET NO: JEK/KAULE

CONTINUATION OF DECLARATION FOR PATENT APPLICATION AND APPOINTMENT OF ATTORNEY

Page 2

PRIOR FOREIGN APPLICATION(S) (35 USC §119)			PRIORITY CLAIMED	
Number	Country	Day/Month/Year Filed	Yes	No

PRIOR PROVISIONAL APPLICATIONS 35 U.S. CODE §119(E)	
Application Number	Day/Month/Year Filed

PRIOR U.S. OR PCT INTERNATIONAL APPLICATIONS (35 U.S. CODE §120)		
Application Number	Filing Date	Status - Patented, Pending or Abandoned

FULL NAME OF JOINT INVENTOR Karlheinz MAYER	CITIZENSHIP GERMANY
RESIDENCE ADDRESS Alfred-Wainald-Weg 12 D-86169 Augsburg, GERMANY DEX	POST OFFICE ADDRESS IS THE SAME AS RESIDENCE ADDRESS UNLESS OTHERWISE SHOWN BELOW
DATE March 18, 1999	SIGNATURE

FULL NAME OF JOINT INVENTOR	CITIZENSHIP
RESIDENCE ADDRESS	POST OFFICE ADDRESS IS THE SAME AS RESIDENCE ADDRESS UNLESS OTHERWISE SHOWN BELOW
DATE	SIGNATURE

FULL NAME OF JOINT INVENTOR	CITIZENSHIP
RESIDENCE ADDRESS	POST OFFICE ADDRESS IS THE SAME AS RESIDENCE ADDRESS UNLESS OTHERWISE SHOWN BELOW
DATE	SIGNATURE

FULL NAME OF JOINT INVENTOR	CITIZENSHIP
RESIDENCE ADDRESS	POST OFFICE ADDRESS IS THE SAME AS RESIDENCE ADDRESS UNLESS OTHERWISE SHOWN BELOW
DATE	SIGNATURE

RWB99.KAULE.DEC

PATAPATT.DEC (WP51-10CT97)

☐ *See following pages for additional joint inventors/priority applications.*